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canyon we had found nine, or perhaps ten, species of ferns, an *Equisetum* and a *Selaginella*.

Just at dusk, as we were coming out of our little canyon into a larger one, we found a *Habenaria* and a broom rape (probably *Orobanche tuberosa* (Gray, Heller.), and a little later, when it was almost too dark to see, Prof. Fitzpatrick caught sight of another *Habenaria*. Orchids are not plentiful around here so we felt peculiarly favored. It was now nearly dark and we were still a long way from home, but we were agreed that though tired we had spent a great and profitable day.

LOS ANGELES, CAL., JUNE 16th, 1913.

Double Sori in *Athyrium*

E. J. WINSLOW

Three years ago, while the author was collecting in northern Vermont and amusing himself by making a rather minute examination and comparison of the three species of our New England ferns that are sometimes called *Athyrium*, fronds were collected from several widely separate plants of a narrow, erect variety of *A. filix-femina*, which generally bears double sori on the outer part of the pinnae where the veining becomes more simple. This seemed interesting as an unusual and perhaps unrecorded peculiarity of structure, and because it raises some interesting questions regarding the relations and classification of the three species under consideration.

Figure 1 is an essentially accurate sketch of a small portion of one of the fronds showing the outline of three pinules and one pair of sori on each; the pair to the left on the two branches of a forked vein, the next pair on a

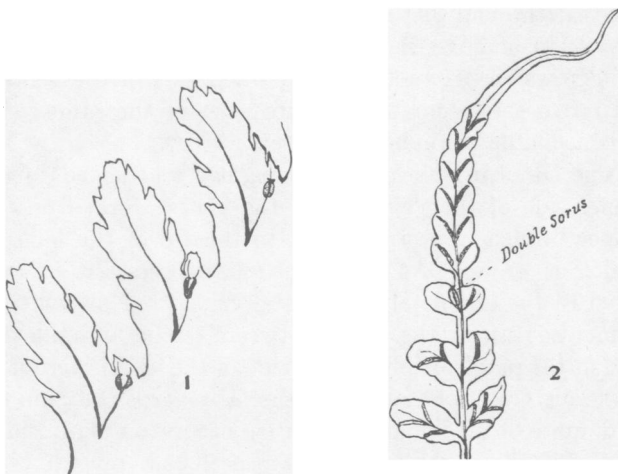


FIG. 1 and 2. Double sori in *A. filix-femina* and *A. angustifolium*.

vein that forks about in the middle of the attachment of the sori, and the third on an unforked vein, a real double sorus.

A few years ago authors generally regarded *A. filix-femina* as our only representative of the subgenus *Athyrium*. Underwood and Maxon included also *A. thelypteroides*, and later, others, including the editors of the current revision of Gray's Manual, following Milde's description, involving the character of the stipe and venation as well as the sori, have made *A. angustifolium* a third *Athyrium*. The variety of opinion is further indicated by the fact that *A. filix-femina* has had, in the course of its varied career as an object of scientific study, such generic names as *Nephrodium* and *Aspidium*, and that *A. thelypteroides*, or *achrostichoides* as some of us prefer to call it, has been called *Diplazium thelypteroides*.

All these genera have been chiefly characterized by the form of the sori and indusia. A straight indusium extending along one side of a veinlet is said to be asple-

noid; if the end of the sorus bends across the veinlet in a crescent or horse-shoe shape it is said to be athyrioid; if it grows across and down the other side of the veinlet, or if two sori occur on opposite sides of the same vein, it is a double or diplazioid sorus.

The sorus in spleenworts is regularly attached to the upper side of the vein, and if the vein is forked on the upper branch, that is, nearest to the tip of the lobe on which it grows. As Dr. Copeland expresses it,—“confined to the acropetal side of the vein.”* Now when a vein leads up to the angle between a lobe and the free end of the pinule or pinna, one side of the vein is acropetal as regards the lobe and the other as regards the pinule, and quite logically a sorus often occurs on both sides. If the pinule is strongly crenate or lobed, several veinlets on each pinule may be so situated as to have a sorus on each side. But in this case the sorus on the side toward the midvein of the lobe is likely to be shorter than that toward the midvein of the pinule. (See figure on page 81 of Vol. I of this JOURNAL.) On the other hand, if the veinlet is forked, as it usually is in *A. filix-femina*, the two sori appear not diplazioid, but on different branches and on opposite sides of them.

Double sori may be found occasionally in other species of *Asplenium*, as noted of *A. pinnatifidum*, by D. C. Eaton. He says, “The sori are mostly single, though here and there one will be diplazioid—most commonly the lowest one on the superior side of the lobe. The free edge is directed toward the middle of the lobe excepting the indusia of the sori nearest the midrib, and these open toward the midrib.”† This is exactly the case as just described for the *Athyrium*.

* Philippine Islands Bulletin No. 28: “The Polypodiaceae of the Philippine Islands,” Edwin Bingham Copeland, page 76.

† “Ferns of North America,” D. C. Eaton, I. 63.

At first thought a hunt for double sori on *A. angustifolium* would seem like a hopeless quest, but such have been seen and reported by one author at least, Miss Slosson.* In the main, the long, parallel sori are laid in regular order on the upper sides of the upper branches of the once forked veins. As there are no lobes or angles, there is no opportunity for double sori. But where the pinnae dwindle to insignificance toward the top of the frond and pass into the graceful acuminate tip, the sori change from the outer to the inner and upper side of the veins. That is—where there are no pinnae the sorus goes to the side nearest the tip of the frond. At the point where this change occurs, if anywhere, we should find double sori. The plant seems rather averse to this arrangement and the first two or three fronds examined had two or three of the last tiny pinnae entirely sterile, although there were sori above and below. But about the fourth frond showed one solitary pair on the very last lobe that could be called a pinna. (Figure 2.)

This somewhat superficial treatment of the subject seems to emphasize the similarities of these three species rather than their differences. The conclusion seems to be that unilateral sori rightly situated relatively to the lobes and branches of the midvein are likely to appear diplazioid in any species, and that double sori are of very little diagnostic value. Whether all curving of sori in *A. filix-femina*, for instance, can be accounted for as a weak manifestation of the doubling tendency is a question for further consideration. In general, forms with much curved indusia also have strongly lobed and incised margins, and where the sorus is completely horse-shoe shaped, as in the *cyclosorum* forms, each sorus is in the position where a double sorus might be expected.

Some authors apparently regard the double sorus as

*"How Ferns Grow," Slosson.

an extreme development of the curved or athyrioid sorus, while others suggest that the athyrioid form is a precursor of the *Dryopteris* form. That *A. filix-femina* is biologically the most recent of the species under consideration is suggested by the fact that it is most common and generally distributed, which indicates that it is best adapted to present conditions; that it is most variable, which may mean that it is a species in the making; and that it is most highly specialized, a smaller portion of the vein being capable of producing sporangia.

D. C. Eaton expresses the belief that no two of these species are closely related. And anyone examining a collection of ferns from various parts of the world is likely to be impressed by the fact that there are two distinct groups, one of which bears a general resemblance to *A. achrostichides* and the other to *A. filix-femina*.

AUBURNDALE, MASS.

Notes and News

A PENNSYLVANIA FERN TRIP

The Doylestown (Bucks Co., Pa.) Nature Club devoted its May meetings, 19th and 26th, to the study of "Ferns" under the guidance of Miss Anna K. Bewley, cryptogammic botanist; George MacReynolds, scribe, and J. Kirk Leatherman, "Dean" of the Doylestown Botanical Club.

On the 19th a "Fern Walk" was taken through the rich floral country adjacent to Doylestown and on the 26th, Miss Bewley gave a talk on "Rare Ferns" at the home of Mrs. George Watson and illustrated her remarks by specimens from her own herbarium and by growing pterodophytes in the nearby wild garden of Miss Ellen D. Smith.

Among the ferns indigenous to Bucks Co., noted by